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Direct Sowing

1. Introduction

Most plantations are established from planted seedlings. Direct sowing or seeding is applicable in a limited number of situations, where seedlings from directly sown seeds can establish fast enough to escape fatal predation, and overcome competition from herbal weeds, grasses, climbers or other aggressive vegetation. Direct sowing is mostly applicable for fast establishing and growing species at sites with scarce vegetation. Examples of sites where direct seeding has been used successfully for afforestation are

a. Barren land, e.g. mine spoils and former farmland (including fallow)
b. Mangrove areas
c. Dry land
d. Underplanting of climax species under pioneers
e. Rehabilitation of grassland
f. Alley/hedge cropping with agroforestry species

2. Some advantages of direct sowing

Sowing seeds directly in the field without prior raising in the nursery saves on nursery costs, transportation of seedlings and laborious planting processes. Transplanting stress is also avoided by direct sowing. Seeds which germinate and grow in the field develop their root system freely without the restriction of a pot, and they do not suffer from the possible adverse effect of root pruning. This can give seedlings from direct sowing an advantage over seedlings planted in the field.

3. Species suitable for direct sowing

Some of the most successful establishment of forest from direct seeding has been relatively large seeded pioneer species, e.g. legumes. The growth habit of many dry zone species forming a deep tap root before any significant shoot development makes both nursery raising and transplanting more difficult. In some areas such species appear to have a relatively good survival by direct sowing. Small-seeded species like pines, eucalypts and acacias have been established by direct sowing on barren or degraded land in Asia and Australia. Large seeded climax forest species in humid areas can be established by direct sowing under a canopy of pioneer trees. In Europe, rejuvenation of timber trees by direct seeding is often carried out in plantations several years before logging. Although regeneration can be damaged during logging, the plants will have a ›head start‹ and competitive advantage over weeds once the canopy trees are removed.

4. Site preparation for direct sowing

Site preparation should ensure that seeds are placed in a suitable germination and seedling substrate and should aim at eliminating or reducing competition from other vegetation. Site preparation is generally similar to traditional planting: grasses, bushes and herbs are preferably cut. Burning debris should as far as possible be avoided because it takes away valuable organic material. However, where material is plenty and implies a fire hazard, burning may be part of the site preparation. Soil preparation should be minimised and only at sowing stations on sloping terrain, while a more thorough preparation such as ploughing and harrowing may take place on more flat terrain. A thorough spot preparation of 15-20 cm diameter and the same depth gives a good germination.

5. Seed technology to enhance germination and seedling development

To ensure fast germination seeds should be pre-treated to break possible dormancy. Pretreatment for hard seed is scarification, e.g. by boiling water, mechanical abrasion, acid or the like. Pretreatment of temperature dependent dormancy is exposure to a high or low temperature. Remember that only imbibed seeds will respond to pretreatment involving physiological processes.

Theoretical root development of potted plants and directly sown seed. Species which tend to form a deep tap root before development of the top can suffer a serious set back by root pruning.

Left: Mechanical sowing machine used for Fagus, Quercus and conifers in Denmark. The sowing machine can operate both on farmland and in open forests.

Right: The machine 'opens' the mineral soil and sows in one operation. Provided with two sowing outlets the machine can sow two species with different type seeds at the same time.

Germination of non-dormant seed may be enhanced by soaking in water to allow water absorption prior to sowing. Once seeds have absorbed water they can germinate. They should thus be sown as soon as possible after soaking.

Small seeds are sometimes inconvenient for direct sowing. To increase the size and thus facilitate sowing, small seeds can have their size increased by pelleting. During this process seeds are first rolled in a sticker for example gum Arabic and then covered with a layer of clay or other material. Growth promoting substances for example rhizobium bacteria or a starting fertiliser can be applied to the material used for pelleting. Pelleting is also used to make seeds uniform size which eases, for example, mechanical sowing. Sowing of very small unpelleted seed is easier if they are mixed and sown together with some seed-like material, e.g. sand or cut rice grains.

6. Sowing devices

During natural regeneration seeds fall, and thus germinate, on the top of the soil. If the environment is favourable to germination, seed kan be sown by manual or mechanical broadcasting. The method is quick and, in case of large and difficult terrain, highly efficient. High seed loss is expected, but for species with plenty of seeds, the potential loss may be compensated for by a higher sowing density.

Covering seeds with soil generally improves success rate, both because of better soil moisture contact, and because seeds are less conspicuous and thus easier escape predation. Small seeds and pelleted seeds sown on flat and cultivated land can be sown by drilling using normal farm equipment. Seeds are sown in rows at a density of, e.g. 25-50,000 seeds per hectare.

Individual seeds can be sown manually in holes prepared by hoes or spades, or by the use of a sowing stick. Sowing sticks are also suitable for sowing large seeds. A sowing stick is basically a pipe, where the lower end is designed to make a hole for sowing, and the seed is dropped into the hole from the pipe. Sowing sticks are easy and quick to use, and seeds can be placed precisely at the sowing spot. However, there is a tendency to bury seeds too deep when using sowing sticks. They are thus mostly suitable for large seeds. Sowing depth should generally not be more than 2-3 times the diameter of the seed.

Pre-germinated seeds are generally fragile if the protruding parts are not protected, for example by alginate cover. Mechanical damage is often encountered during machine sowing, or where soil is trampled hard over the seed hole.

7. Protecting seeds from predation

Germinating seeds are prone to predation especially by birds and rodents. Predation is highest when seeds are sown in rows on open fields, because birds and rodents quickly learn where to look. Pesticides are usually not very useful because it has only short term effect. The most efficient, yet not always effective is physically covering seeds, e.g. with a layer of grass, leaves, woody debris or soil.

8. Post sowing care and maintenance

Young seedlings will suffer from competition from other vegetation especially when young. Where possible, seedlings should be spot weeded after germination and weeding repeated regularly during the establishment phase.

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